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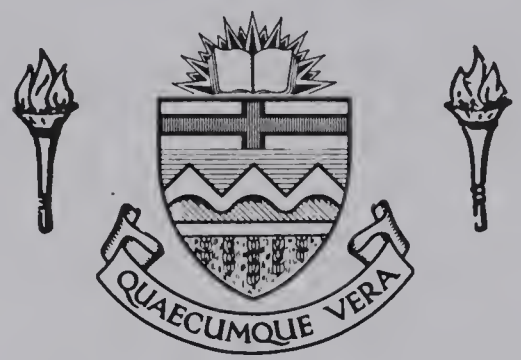

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Testing the Concentration-Collusion Doctrine on Canadian Industry: 1960-1978

by

Michael Justin Hopkins

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Testing the Concentration-Collusion Doctrine on Canadian Industry: 1960-1978 submitted by Michael Justin Hopkins in partial fulfilment of the requirements for the degree of Master of Business Administration.

Abstract

The Concentration-Collusion Doctrine suggests a paradigm whereby industrial structure determines firm performance and conduct. Specifically, it alleges that high concentration in an industry tends to promote higher profitability because firms have the ability to restrain competition, either by explicit agreement or through conscious parallelism. Decades of American and Canadian empirical studies have supported this allegation by claiming to show a positive relationship between profits and concentration. The 'Efficiency Hypothesis' proposes that it is actually performance and conduct that determine structure. It is argued that while there may be a positive relationship found between concentration and profitability, there are other explanations besides collusion. Two sources of a *spurious* long-run positive relationship between profits and concentration could be the neglect of the risk factor of a firm or industry in the measurement of profitability and the use of cross sectional, as opposed to time series analysis. This study looks at the accounting returns of Canadian manufacturing firms over time, discounted by their risk, and finds a negative relationship between profit and concentration, which is true whether profit is adjusted for risk or not. Moreover, this relationship extends over the whole range of concentration. The results suggest that it it is not the neglect of risk which explains the positive relationship found in previous studies but rather the limited time frame of those studies. The study is a companion to a more extensive, stock market data study by Roger Beck.

Table of Contents

Chapter		Page
1.	Introduction	1
2.	The Profit-Concentration Issue	3
	2.1 The Concentration-Collusion Doctrine	3
	2.2 The Efficiency Hypothesis	15
3.	Canadian Research	20
4.	Methodolgy	26
	4.1 Performance Measurement	26
	4.2 Performance Data Collection	29
	4.3 The Nature of Accounting Performance Data	32
	4.4 Concentration Data and Measurement	33
	4.5 Hypothesis Testing	34
5.	Results	39
6.	Analysis	52
7.	Conclusions	57

1. Introduction

Over the last decade, Canadian public policy increasingly has been focused on the issue of market concentration and its presumed effects on competition and prices. Concentration was studied by a Royal Commission, [1] was one justification for the eight-year investigation into the petroleum industry [2] and was the rationale for the repeated attempts at amending merger policy [3] of the *Combines Investigation Act*. [4]

Over this same period, in the United States, the relevance of industrial concentration to competition has been seriously questioned, first by academics, then by the courts, and finally by the enforcement agencies themselves. For decades it had been generally assumed that concentration encouraged either explicit collusion among leading firms, or at least interdependant pricing equivalent to tacit collusion: the Concentration-Collusion Doctrine. The result was the belief that a large number of firms was competitive, and anything that reduced that number was uncompetitive. This view became encrusted in a structure-conduct-performance paradigm whereby structure is supposed to determine conduct, which in turn determines performance. This paradigm was buttressed by empirical studies done from 1935 to 1970, which consistently claimed to have positively tied concentration with profit.

Beginning in the 70's though, a revisionist group of economists critically examined these studies

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[1]REPORT OF THE ROYAL COMMISSION ON CORPORATE CONCENTRATION (Warren J. Chairman 1978).

[2]THE STATE OF COMPETITION IN THE CANADIAN PETROLEUM INDUSTRY (Supply & Services Can. 1981).

[3]The latest attempt was Bill C-29, An Act to amend the Combines Investigation Act and the Bank Act and other Acts in consequence thereof, Second Session, Thirty-Second Parliament, 32-33, Elizabeth II, 1983-84, First Reading April 2, 1984; COMBINES INVESTIGATION ACT AMENDMENTS 1984, BACKGROUND INFORMATION & EXPLANATORY NOTES (Consumer & Corporate Affairs, Canada 1984). The Bill, which was dropped from the order list as a result of the federal election of 1984 was supposed to generally toughen the current Act, though it did not fully follow through on the hard-hitting Proposals for Amending the Combines Investigation Act: A Framework for Discussion (Can. Dept. of Consumer & Corporate Affairs, Apr. 1981, mimeo). With respect to mergers, a test based on assets and revenues was used. Every company above the threshold would have been forced to notify the government in advance of an intended merger. There could then have been a civil review of the proposal. This was thought to be a more effective way of frustrating 'objectionable' mergers than the present s.33 criminal provision. and its onerous standard of proof.

[4]R.S.C. 1970, c. C-23, *as amended by* S.C. 1976, c. 76, s. 14.

and exposed theoretical and statistical error. They then turned the paradigm on its head, and suggested that it is in fact performance and conduct that determine structure.

In Canada, this revisionism has had limited impact. This is at least partly due to the fact that most of the few domestic studies we have seem to confirm the traditional view. The study here is a time series analysis using risk-adjusted performance. In both regards it is unique in Canada. It is also unique in its finding of a significant *negative* relationship between profits and concentration. On the other hand, it shares many of the problems of the existing studies and is far less sophisticated in its statistical design because of its use of only two variables. However, while it is therefore far from a definitive contradiction of the Concentration-Collusion Doctrine, it is a positive first step in putting the Concentration-Collusion Doctrine to the test in Canada.

2. The Profit-Concentration Issue

If concentration and profitability are genuinely negatively related or unrelated, the Concentration-Collusion Doctrine fails. However, if they are genuinely positively related, there are at least two possible explanations: (1) that the leading firms are colluding to extract abnormal profits; or (2) that the profits being earned are a short-run reflection of the efficiency of the concentrated structure in particular markets, or a long-run product of other *economic* factors or circumstances. It is a debate that has been carried on almost exclusively in the United States.

2.1 The Concentration-Collusion Doctrine

During the Great Depression and the inflation of the 1940's and early 1950's, a group of economists blamed the downward price rigidity and upward price flexibility on the failure of markets to deal with "market power". It was hypothesized that firms in concentrated industries colluded, whether explicitly or tacitly, to restrain output and raise and maintain prices to and at supracompetitive levels. The erratic money growth-rates, recursive expectations and government intervention restricting wage and price adjustments as well as domestic and international competition went unnoticed, or misunderstood. Since 1935, certain profit and concentration studies tried to show the existence of "administered pricing", and until recently were taken by many value as confirmation of the perverse behaviour that was supposed to result from "market power". [5] In fact, they had serious defects: they relied on accounting returns that ignored intangible capital, inflation, age of assets and write-offs; they were confined to surviving firms, thereby understating the total investment behind the observed profits; they used inaccurate data, unrepresentative industry and firm samples; they misinterpreted the statistical relationships found; they applied inadequate methodology; they

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[5] *See*, W. REEKIE, INDUSTRY, PRICES, AND MARKETS 61-64 (1979); Bock, *From Administered Pricing to Concentrated Market Pricing*, 12 CONFERENCE BOARD RECORD 20 (Feb. 1975).

classified industries subjectively and misrepresented temporary disequilibria as historical trends. [6] Nevertheless, they served to entrench the paradigm that structure determines performance and conduct.

The Concentration-Collusion Doctrine assumes that among leading firms in a concentrated industry, interdependence in pricing and other decisions is recognized and acted upon in a manner different from that which could occur in a less concentrated situation. The supposed result is known in law as conscious parallelism, or more accusatorially, tacit collusion. Cartel prices so achieved are said to persist as long as entry barriers and a lack of substitutes insulate the tacitly colluding firms from competition.

Concentration and barriers to entry are often so closely related by economists that some have argued that it is the barriers that determine the concentration in the first place. Douglas Greer, for example, wrote that barriers "help explain variances in observed concentration, because high barriers tend to be associated with high concentration." [7] The proposition is that few entrants appear in concentrated industries because high barriers shut them out, whereas many enter the low barrier, less concentrated industries, keeping both industries that way. Support for this proposition was derived from empirical studies, most notably by Joe Bain, estimating the height of advertising and product differentiation barriers, using subjective standards. [8] The position was directly challenged by Yale Brozen who, using the more objective measure of entry rate in relation to concentation in thirty-five manufacturing industries between 1947 and 1972 found a positive relationship between concentration and entry, suggesting the existence of lower barriers in highly concentrated industries. [9] Lester Telser, in a study of concentration and profitability had predicted that entry would be tied to profitability, *ie*. to attractiveness, not concentration, [10] and this was supported by Brozen's study.

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[6]Y. BROZEN, CONCENTRATION, MERGERS & PUBLIC POLICY 8 (1982).
[7]D. GREER, INDUSTRIAL ORGANIZATION & PUBLIC POLICY 170 (1980).
[8]J. BAIN, BARRIERS TO NEW COMPETITION (1956); Mann, *Seller Concentration, Barriers to Entry, and Rates of Return in Thirty Industries, 1950-1960,*. REVIEW OF ECONOMICS & STATISTICS 296 (Aug. 1966).
[9]*Supra* note 6, at 115.
[10]Telser, *Some Determinants of the Returns on Manufacturing Industries* in

[11]

Anti-competitive behaviour is rarely as simple as such terms as conscious parallelism or tacit collusion suggest. [12] First there must be agreement on the action, and then there must be an effective means of monitoring against cheaters.

There are a number of possible actions that firms could take to facilitate these tasks, but none are costless. The most obvious and complete facilitator is explicit agreement. At the extreme, such an agreement would establish a rationalization cartel with profit pooling, whereby the participant firms should act exactly as units of one large firm. Explicit conspiracy is costly because of the high information needs coupled with the secrecy needed to avoid litigation under the conspiracy laws. [13] Moreover, the incentives to cheat often frustrate the most elaborate of arrangements. [14]

Leadership is a common facilitator whereby one firms takes the initiative and the rest simply follow. The leadership may be assumed by a dominant firm that feels capable of forcing followership, the result of a collusive agreement that designates a leader, or be barometric, in the sense that the leader only acts as the market would eventually. [15] The problem is that firms expected to follow naturally have some distrust for the motives of the leader, who, aware of this distrust, must make costly contingency plans in the event that they are not followed.

Rule of thumb pricing, or "full cost plus" pricing is a simple means of price-fixing,

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[10](cont'd) COMPETITION, COLLUSION & GAME THEORY (1972).

[11]*Supra* note 6, at 116.

[12]*See, generally,* F. SHERER, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE ch. 5 & 6 (2nd. ed. 1980).

[13]Antitrust litigation in the United States is a staggering cost, both to the parties involved, and to society at large. As a result of the private costs, considerable investment in avoidance is justified. *See* R. POSNER, ANTITRUST LAW: AN ECONOMIC PERSPECTIVE 232 (1976).

[14]For a study of one of the more notable of such failures, *see* R. SULTAN, PRICING IN THE ELECTRICAL OLIGOPOLY (1974). In his analysis of the American electrical generator connspiracy, Sultan documented how, notwithstanding significant investments made by the conspirators in the conspiracy, it not only failed to realize its objectives, but also attracted one of the most costly civil damage suits in antitrust history.

[15]Markham, *The Nature and Significance of Price Leadership* , 41 AMERICAN ECONOMIC REVIEW 891 (1951).

based on the goal of an acceptable long run return.[16] Although its simplicity minimizes costs, the relative rigidity of costs relative to demand prevent it from successfully approximating a profit maximization strategy, so that the benefits may not be that great either.

Focal point pricing is a psychological theory of familiarity which says that firms believe that they can price within accepted ranges and by accepted increments. [17] Such "natural" shifts are supposed to be non-threatening but carry with them an implicit warning that that, and that alone, is the proper price. Again, this mechanism is cheap, but not that effective. To a large extent, the effectiveness of the signals sent out seems to assume a mature and stable industry.

A last facilitator of price-fixing is the use of order backlogs and inventories. This is not so much to change price as it is to maintain price by witholding supply. It has high information costs if witheld supplies are going to result in the desired price and presupposes effective monitoring and sanctions to restrain firms from breaking ranks and dumping supplies for quick revenues.

Regardless of the investment firms may be willing to make in facilitation strategies, there are a number of firm, industry and market conditions that frustrate coordination of these strategies.

First is the factor of industry concentration. The more firms that operate in an industry, the more complicated it is to coordinate - strictly from a logistical point of view. In addition, it is harder for colluders to detect cheaters. If all but one of the firms that are party to an agreement to raise prices notice that their share of the market is eroding while the one firm's share is increasing, they are likely to suspect price cutting. Random changes in patronage would not be expected to be going all in one direction. With more firms, the decrease in market shares of the honourable conspirators will be less, assuming that the firms are all roughly of the same size. [18] More generally, the more firms that there are, the more that cheaters will, or at

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[16]Hall & Hitch, *Price Theory and Business Behaviour*, 2 OXFORD ECONOMIC PAPERS 12 (1939).
[17]T. SCHELLING, THE STRATEGY OF CONFLICT ch.2-3 (1960); Sherer, *Focal Point Pricing and Conscious Parallelism,* 12 ANTITRUST BULLETIN 495 (1967).
[18]Stigler, *A Theory of Oligoploy*, 72 JOURNAL OF POLITICAL ECONOMY 11

least may hope to be lost in the crowd. Some have even suggested that the difficulties of coordination rise at a nearly exponential rate with the number of firms. [19] There is also the consideration that the more firms there are in an industry, the more likelihood there is of irreconcilable individual firm preferences resulting, in the extreme, in the emergence of one or more "mavericks". However, while high concentration may minimize these problems, nothing short of monopoly will eliminate them.

Inelastic demand is important to a successful price-fixing scheme. Elastic demand will mean that raising prices beyond the competitive level will result in minimal gains as consumers either do without the product or substitute other goods. Successful monitoring also relies in part on inelastic demand. Where demand is inelastic, a price-cutter's increase in sales will be directly felt as a decrease in sales by its competitors. However, if demand is elastic, a price-cutter's gains may come largely from new business attracted to the industry by the lower prices. In addition, the cost of capacity adjustments is lower where demand is inelastic. Since quantity varies only marginally as prices are raised, there is relatively little capacity made surplus. This aspect, however, makes the elasticity of demand a double-edged sword for price-fixers. Inelastic demand also makes it easier for firms to expand to the competitive output should the agreement collapse. And to the extent that inelastic demand facilitates cartel formation, it also contributes to its dissolution since the resulting higher gains attract new entrants. The more existing firms begin to earn, the greater the danger of firms entering as prices rise above the competitive level. Such entry then breaks up the agreement. Not surpisingly then, attempts at cartelization are most common during business recessions and during periods of falling prices, as it is during those times that the risk of entry is least. Naturally enough, cartelization was most prevalent worldwide during the Great Depression of the 1930's. Another possible reason for the appearance of cartels during business downturns is that slack demand is often expected to be only a short-run condition. The alternative to a cartel

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[18](cont'd) (Feb. 1964).

[19]*See* A. PHILLIPS, MARKET STRUCTURE, ORGANIZATION AND PERFORMANCE 29-30 (1962); Williamson, *A Dynamic Theory of Interfirm Behavior*, 79 QUARTERLY JOURNAL OF ECONOMICS 600 (1965).

agreement is pricing at short-run marginal cost, with the possibility that one or more firms will fail. The cost in ordinary circumstances of cheating and being discovered is that the industry returns to its competitive situation, with firms more or less as they were before they colluded. In depressed circumstances, there is a likelihood that one firm, perhaps the cheating one, will not survive a breakdown of the agreement. As an empirical matter, however, cheating is frequent during the darkest days of a business slump, as greed only is exceeded by desperation. Asch and Seneca found a "consistently negative and significant relationship between firm profitability and the presence of collusion. [20] They dismiss the notion that collusion leads to lower profits and focus instead on an alternative explanation. Poor profits motivate collusion, and, one might add, even collusion that might someday be detected. It might conversely be argued that high, or at least satisfactory profits are a disincentive to collusion as the risks are perceived to be greater when the situation is less deperate.

A viable competitive fringe or import potential is necessary for entry to limit cartelization. Firms that have successfully colluded to raise prices must be confident that a competitive fringe cannot undercut, expand production and take away market share, or that imports could not arrive on the scene to do likewise. The existence of tariffs may be an effective protection from imports, but the threat of an actual or potential competitive fringe is less readily thwarted.

Heterogeneous, complex and changing products complicate agreement on pricing because the products are too difficult to meaningfully compare.[21] Products which are perfect substitutes for one another, without discernable physical or subjective differences, simplify agreement on price, as it is apparent to the parties that each is receiving the same price for the same product. Consequently, the goods most suited to collusive agreements are such items as

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[20]Asch & Seneca, *Is Collusion Profitable?*, 58 REVIEW OF ECONOMICS & STATISTICS 1 (Feb 1976).

[21] There are many examples of the coordination difficulties associated with static and dynamic product heterogeneity, perhaps the most extreme being the problem of areospace firms bidding to secure government contracts for the development of weapons and space systems. *See* R. SMITH, CORPORATIONS IN CRISIS ch. 9-10 (1963).

refined minerals, standard chemical compounds and agricultural goods. However, if differences do exist, as will almost inevitably be the case to some degree when dealing with complex products, there will be some basis for disagreement. It generally is difficult to effectively collude at the manufacturing level in the case of products such as automobiles, household appliances and clothing. Even if a manufacturer of such a product kept to an agreed-upon price, he would have an incentive to offer more product in the form of extra or better features in order to lure buyers from other firms. Since such extras are costly, the returns for all firms will be driven to the competitive level as all parties to the collusion adopt this tactic. Actually, this same tendancy is evident even in markets where the good is quite homogeneous. Reciprocal purchases and extra services, for example, can be used to reduce the actual price below the cartel price for a good that is indistinguishable accross firms.[22] Standardization agreements are one means of handling the problem, but they are difficult and costly to implement in the case of complex products, near impracticable in the case of changing products, sometimes subject to combines prosecution [23] and always vulnerable to internal collapse in the event of deviation. [24]

In the case of changing products, focal point pricing can be one response, but that is at best a rough approximation of equalized prices and does little to assist in the assessment of the "proper" price for new products.

Differing marginal costs create different preferred prices for different firms. When individual firms have costs below the industry average, they will tend to be dissatisfied with the industry pricing of the product as they could charge a lower price, sell more and increase their profits. However, if they do charge their own optimal price, high cost firms that are being undercut will have no choice but to retaliate, and a desperate price war could result.

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[22]That is why when interest ceilings were in effect in the banking industry deposits were attracted by "gifts" and why while airline rate regulation is in effect airlines compete on seat width and legroom.

[23]Section 32(1) & (2), CIA.

[24]An example of standardization agreements and their problems would be the American steel industries' explicit agrrements concluded to secure uniform treatment of extras. *Steel Gets Hit with the Big One*, BUSINESS WEEK, 11 Apr. 1964, 27-28.

The lower the fixed costs of the industry, the easier it is for new firms to enter once long-run collusive supracompetitive pricing makes the industry attractive. This threat limits the time frame within which colluders can expect to realize abnormal returns. In general, entry is not likely where a great amount of industry-specific capital is required and the collusive pricing is expected to be a short-run experiment or unable to maintain itself in the face of entry. However, in a modern economy at least, where capital is easily available and mobile, the prospect of large returns for as little as three to five years will be sufficient to atrract entry. Moreover, while existing firms may have found it most efficient to operate with a large stock of fixed capital, the bigger margins may allow temporary entrants to operate on a more makeshift basis. Lastly, while high fixed costs may provide colluders with protection from external pressures, that same cost structure may cause pressure from within. If firms in the industry have relatively high fixed costs, during recesssionary periods, the pressure of those costs will be an incentive for those firms to price below average total cost just to realize some contribution to fixed costs. For the industry to maximize industry profits, the desired response to a recessionary period is to restrict output and thus maintain price. While this is easy enough to accept for the firm with high marginal costs, cheating by the high fixed cost firm may be a simple matter of survival.

The absence of barriers to entry limits supracompetitive pricing. Some supracompetitive pricing is possible to the extent that potential entrants will discount the rewards of entry by the risk, which will include the threat of predation by the incumbants. However, as Harold Demsetz has shown, if *potential* sellers are able to negotiate sales with buyers, and buyers can freely offer their business to them, then not even a monopolist will be able to extract a supracompetitive price without losing some trade.[25]Barriers to entry are anything that makes costs greater for newcomers than existing firms. As mentioned, high fixed costs have been suggested as one barrier, but to argue that it is prevalent is to argue that there is some pervasive and chronic failure in the capital markets that restrains capital from going to areas where high

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[25]Demsetz, *Why Regulate Utilities?*, 11 JOURNAL OF LAW & ECONOMICS 55 (April 1968).

returns can be had, as well as that production is an inflexible, capital-intensive activity. Moreover, high fixed costs could only be a prevalent barrier if high fixed costs were prevalent. As is apparent from the radically diminishing product life cycles, the general trend must be away from such costs. [26]

It has been argued that advertising constitutes a barrier to entry because new firms find it difficult to win customers away from the existing firms who have won their loyalty through advertising. There are two problems with this argument. First, many marketers today believe that there is in fact no such thing as brand loyalty and that it is purely a case of passing familiarity. [27] Second, advertising is expensive to existing firms as well as to potential entrants, and it not clear why existing firms would enjoy any significant long-run cost advantage over equal size entrants once the learning curve was mastered. While some would like to interpret advertising as a weapon, and may even use it as such in the case of saturation advertising, it is used most rationally as a valued information service to the consumer. [28] Advertising may be best viewed as a capital stock of product recognition and product information which is productive to the extent that it economizes on the consumers' scarce search time. The fact that explicit cartel agreements do not specify some minimum amount of advertising expenditure from each firm makes it hard to belive that colluders themselves see advertising as playing a role in the maintenance of a cartel.

A variant of the advertising barrier argument is the notion that product differentiation and brand proliferation are means for existing firms to flood the market and eliminate any lucrative new product variations that a firm could adopt to achieve succesful entry. This rests on the same contention, widely rejected in marketing, that it is possible to affect consumer behaviour through spurious product qualities. Product differentiation has been more recently explained as a response of firms to what consumers with varying incomes and interests

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[26]P. KOTLER & R. TURNER, MARKETING MANAGEMENT ch. 13 (1981).
[27]Frank, *Is Brand Loyalty a Useful Basis for Market Segmentation?* JOURNAL OF ADVERTISING RESEARCH 27, at 28 (Jun. 1967).
[28]*Supra* note 26, at 530.

demand.[29] A further point is that product differentiation, as explained, makes it harder to agree on price as the products are increasingly heterogeous, so that even if product differentiation somehow was a barrier, doing it as a collusive strategy would cause as many internal probems as it would solve external ones. Economies of scale are a last alleged barrier where a market can support only one or two producers operating at minimum average cost. One problem here is that while economies of scale may well determine the number of firms that may operate in an industry, they have nothing to say about which firms will do the producing if potential suppliers compete. The idea that economies of scale are determinative in any sense is weak, as evidenced by the successful existence of firms of varying sizes in the same industry. Clearly, factors other than particular technologies and products govern firm size. Harold Demsetz summarized the barriers to entry issue as follows:

> *It was decided - largely by intuition, not analysis - that the use of advertising and capital, as well as the existence of economies of scale, created what Bain called barriers to entry of resources from outide the industry. No clear rationale was given as to why the use of particular kinds of inputs should create such barriers when these same inputs are available to firms inside and ouside the industry.* [30]

Transportation costs limit the pricing of any effective local conspiracy to the nearest noncollusive price, plus the costs of transportation. Where transportation costs are minimal, an effective conspiracy may have to be worldwide.

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[29]Rosen, *Hedonic Prices and Implicit Markets:Product Differentiation in Pure Competition*, 82 JOURNAL OF POLITICAL ECONOMY 34 (Jan. 1974).
[30]Demsetz,*Two Systems of Belief about Monopoly*, in GOLDSCHMIDT *et. al.*, INDUSTRIAL CONCENTRATION 168 (1974).

Technological change, aside from changing products, also changes cost structures. The more rapidly firms' cost functions are altered through technological innovation, and the more unevenly these changes are diffused throughout the industry - whether because of firm size or local conditions - the more likely it is that there will be conflict regarding pricing choices. [31] As a result, it is unlikely that there will be collusive agreements for such products as personal computers or sound equipment. It is important to note that it is the large firms that are most likely to benefit from new technologies, in proportion to their scale of operation, and therefore are the ones most likely to be first in their introduction. Yet it is these same firms that are supposed to be the leaders in collusive arrangements which would raise their costs while benefiting all firms in the industry. Edwin Mansfield, in his study of the relationship of technological innovation and firm size, found that, "other things equal, the length of time a firm waits before using a new technique tends to be inversely related to its size." [32] He attributes this to three factors: (1) larger firms can accept risk more easily; (2) a given technique has wider applicability in a large firm; and (3) a large firm retires and replaces more plant and equipment in any given time period. A large firm, in order to benefit from its large size and compensate for its higher span-of-control costs must innovate. Holding back damages them more than any other firm in the industry.

Depressed demand increases the pressure to cut prices whatever the cost structure of the firm. Although firms in a highly concentrated industry know that there is only so much profit to be had from a market, and that ideally they should not act in a way that would reduce the aggregate profit in which they all share, as that total available profit shrinks with demand, the rewards of sticking together pale in comparison to what can be had quickly by breaking

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[31]For example, National Steel, after installing new and more efficient continuous strip mills during the 1930's became an active price cutter, pulling along the rest of the industry. L. WEISS, ECONOMICS AND AMERICAN INDUSTRY 296-97 (1961).

[32]Mansfield, *The Speed of Response of Firms to New Techniques*, 77 THE QUARTERLY JOURNAL OF ECONOMICS 291 (May 1963). On the basis of his empirical findings, Professor Mansfield predicted that "if one firm is four times as large as another (the profitability of the investment in the innovation being the same for both), the chance that it will introduce an innovation more rapidly than its smaller competition seems to be about .80." (p.309)

ranks.

The size distribution of buyers' orders limit coordination insofar as large, infrequent and irregular orders predominate. Any decision to undercut a price on which industry members have concurred requires a balancing of the probable gains and the costs. The larger the orders, the greater the gain, and the more infrequent and irregular they are, the less the likelihood of detection.

The number and size of buyers can also restrain successful collusion. If there are large volume buyers of the product, any attempt at long-run supracompetitive pricing will encourage such buyers to make the product themselves. In fact, as potential entrants go, large buyers may be very efficient producers, as they often are intimately informed about the technologies and costs of production. And if they are induced to enter, they may well go beyond supplying themselves, and compete with their former suppliers for other buyers.

Secrecy and retaliation lags increase the incentive to cheat by lowering the expected costs. If price cuts can be made in secrecy, detection may be delayed or even avoided so that gains dominate the costs. The only situation in which this is near impossible is when sealed bids are taken and publicly announced, since the chiseler is exposed immediately. However, even where there is detection, there may be valuable retaliation lags due to logistical difficulties in changing prices, or uncertainty on the part of the detector as to whether or not the price cut was intentional or significant.

Finally, there is the fact of a less and less cozy social structure in industry. [33] Until recently, leaders of industry tended to come from the same social class, attend the same schools and belong to the same clubs. In Canada, Peter Newman tried to write convincingly about a Canadaian Establishment, but as the segmentation of his own books reflect, the Establishment is becomingly a little too fragmented to fit the term. [34] Today, industry increasingly is being headed by individuals from all strata of society, who have been trained in the fiercely

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[33]A. PHILLIPS ch. 2.

[34]P. NEWMAN, THE CANADIAN ESTABLISHMENT (1975); P. NEWMAN, THE CANADIAN ESTABLISHMENT - THE ACQUISITORS (1981).

competitive and individualist business schools. The result has been the emergence of the businessman over the business class.

2.2 The Efficiency Hypothesis

Up until the beginning of the development of the Concentration-Collusion Doctrine in the 1930's, economists perceived the growth in industrial concentration as a response to technological advances in transportation, communications and mass-production. In contrast to the antitrust legislation being enacted, there was little academic concern for monopoly, much less oligopoly structures, as it was thought that the market controlled anti-competitive behaviour. Large firms that reduced costs, increased efficiency and improved their products, and did so continuously, prospered and were seen as benefiting the consumer. [35] Large firms that believed they enjoyed market power and attempted to raise prices above competitive levels lost their position to old and new competitors. [36]

For the forty years during which the Concentration-Collusion Doctrine enjoyed uncritical acclaim, the paradigm that structure determined performance and conduct dominated those long-standing perceptions. Beginning in the 1970's, a group of economists that would become known as the Chicago School finally challenged the paradigm, and indeed turned it on its head. Questions were asked about why small firms in concentrated industries did not earn the superior profits they were supposed to enjoy underneath the price umbrella. Instead of assuming that the sometimes slightly higher profits earned by the leading firms in concentrated industries were the result of collusion and poor performance, an alternative, and simpler hypothesis was made - that better profits could be realized by cost reductions, and that market share could be earned by superior performance. In other words, that performance and conduct determine structure, and not the other way around. [37] Concentration occurs where it is the

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[35]MERGERS IN INDUSTRY (National Industrial Conference Board, 1929).
[36]A. DEWING, CORPORATE PROMOTIONS & REORGANIZATIONS (1914).
[37]Phillips, *Structure, Conduct and Performance - and Performance, Conduct and Structure?*, in J. MARKHAM & G. PAPENEK, eds., INDUSTRIAL ORGANIZATION & ECONOMIC DEVELOPMENT 26 (1970).

efficient structure for producing and distributing a product and for adapting to technological change, shifting demand and increasing regulatory requirements. This counter-argument to the Concentration-Collusion Doctrine has been labelled here, the 'Efficiency Hypothesis'.

In general, there are certain efficiencies from size, and these come from several sources.

For one, in the short-run, large prouction runs minimize unit costs by spreading the fixed costs of production over more product. This is confirmed by the positve relationship found between concentration and productivity by Steven Lustgarten. [38]

One of the benefits and sources of large size is the learning curve, whereby past experience is used to increase productivity. It has been found that the cost per unit of output in a firm is inversely related to the amount of experience it has accumulated in producing a prouct. [39] The steeper the curve, the bigger the cost savings as a result of experience, and the greater the incentive to expand to get that experience. A study by Professors Paul McCracken and Thomas Moore has shown that the learning curve is typically flat in unconcentrated industries, and steep in concentrated industries, providing good economic evidence for why industries are structured as they are. [40]

Another advanatge of concentration and the resulting distribution of firm sizes is that the cost of capital is lower for the larger than for the smaller firms. [41] One reason for this is the lower per-dollar cost of raising capital in placing large issues of securities. [42] With lower flotation costs, more capital is made available to the firm for every dollar provided by investors.

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[38]S. LUSTGARTEN, INDUSTRIAL CONCENTRATION, PRODUCTIVITY GROWTH, AND CONSUMER WELFARE (American Enterprise Institute, 1982).
[39]PERSPECTIVES ON EXPERIENCE (Boston Consulting Group, 1968).
[40]P. McCRACKEN & T. MOORE, COMPETITION AND MARKET CONCENTRATION IN THE AMERICAN ECONOMY (1974).
[41]Blair & Peles, *The Advantage of Size in the Capital Market: Empirical Evidence and Policy Implicatons* (working paper, Center for Study of American Business, Washington University, Dec. 1977).
[42]Archer & Faerber, *Firm Cost and the Cost of Externally Secured Capital*, 21 JOURNAL OF FINANCE 69 (1966).

Large firms, because they have a better capacity to absorb large losses, are better able to accept good, yet risky projects, whose high risk would be prohibitive to smaller firms. As a result, large firms have more opportunities than small ones, and so, over the long-run, should do better. An example of the riskiness of the business in which concentrated industries typically are engaged was given by Yale Brozen who documented the failure of over 1000 firms in the auto industry where only a handful operate today. [43] Professor Brozen argues in this regard that if the survivors earn high returns they deserve them.

Much of the economic literature on concentration argues that greater incentives for innovation and research and development exist in large firms and in concentrated industries. While there is no clear relationship between R & D expenditures and concentration, [44] it is the largest firms that perform most R & D. This, however, is not the important factor. It is not increased input, *ie.* R & D expenditures that is desireable, but increased output, whether of product or innovations. The only objective measure incorporating innovation from all sources is the rise in total factor productivity in an industry. As noted, Professor Lustgarten found there to be a positive relationship between that and concentration.

Large firms, because they are more productive, can and do invest more in human capital. Each worker is more valuable to a more productive firm, and they therefore will pay more for, and get the best worker.

Similarly, large firms are the only kind whose size of operation justifies the expense of the very best managers. Such managers are a scarce resource, and so are bidded upon competitively by different firms. But because a big firm has more to benefit from a good manager, they can pay more. As a result, there is a tendancy for the best managers to go to the biggest firms. [45]

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[43]Brozen, *The Concentration-Collusion Doctrine Revisited*, working paper, Jun. 1977, at 35.
[44]Kamien & Schwartz, *Market Structure and Innovation: A Survey*, 13 JOURNAL OF ECONOMIC LITERATURE 1 (1975)
[45]Oi, *Heterogeneous Firms and the Organization of Production*, 21 ECONOMIC INQUIRY 147 (1983).

Instead of using concentration as a guide to public policy, it is argued that the focus should be on explicit collusion, not the tacit collusion suggested by the Concentration-Collusion Doctrine. Further, it is argued that in looking for the explicit colllusion, authorities should look first at the low profit industries, where the lack of entry will allow at least short run attempts to raise prices. In the high concentration industries that earn higher profits, entry frustrates any attempted collusion, as studies indicating a negative relation between profitability and explicit collusion have shown. [46] It is more desperation than greed that induces firms to risk explicit collusion.

Concentration is not the inevitable end result of economic activity. In the absence of government intervention, concentration should occur and persist only where it is efficient. While Canadian commerce is popularly perceived as dominated by a relatively small number of large firms, leading firms in industries do not typically dominate output or even show a uniformly high percentage of output. The Royal Commission on Corporate Concentration concluded in its 1978 report [47] that aggregate concentration - the percentage of economic activity accounted for by the largest firms - actually decreased from 1923 to 1966, and then did not significantly change between 1966 and 1975. Industrial concentration - the fraction of total activity in a given industry attributable to a fixed number of the largest firms in that industry - did increase between 1948 and 1972. However, the changes occured shortly after 1948, with industrial concentration stable since then. More recently, Statistics Canada reported that, using a top-four firm measure, 91 of the 151 industrial sectors surveyed saw a decrease in concentration from 1970-80, one experienced no change, and 59 had an increase. [48] Moreover, such percentages take no account of imports, production in shops rebuilding manufactured items or production in retail shops. Many maufacturers must also compete with cottage producers. Even in such high concentration industries as passenger transportation, the figure

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[46]Asch & Seneca, *Is Collusion Profitable?*, 58 REVIEW OF ECONOMICS & STATISTICS 1 (Feb. 1976).

[47]*Supra* note 1.

[48]INDUSTRIAL ORGANIZATION AND CONCENTRATION IN MANUFACTURING, MINING AND LOGGING (Statistics Canada Catalogue #31-402, 1982).

can be misleading if one regards air, rail and bus all as parts of the intercity pasenger transportation industry. As for industry concentration, differing economic characteristics cause a wide variation in ratios, and these exist internationally, suggesting that fundamental technological and economic factors determine industry structure.

When viewed from the perspective of the Efficiency Hypothesis, concentration assumes a far less threatening image than that that the Concentration-Collusion Doctrine would impose on it. Concentration is a mere manifestation of other fundamental factors, without any connection to collusion. And profitability, if it is tied to concentration, should be the result of the real, competitive economic advantages of concentration. These higher returns could be expected to be a short-run phenonomena that will be stopped by imitation and entry. But even then, whenever empirical studies compare average performance over a limited time period, some positive relationship is to be expected. It is also possible that there is a real, long-run, systematically positive relationship between the two, but again, not because of collusion. When we see certain firms *consistently* outperforming the rest, getting big and staying big, there are at least three explanations. First, managers might be loyal to the firm and short circuit the market process by which other firms' bidding would force the managers' firm to pay him his full value. Second, the firm may be a constant innovator, so that entry and imitation always lag behind them. Finally, there is an unknown residual factor, by which certain firms simply do better than others. [49]

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[49]Demsetz,(Hoover Institute study).

3. Canadian Research

Canadian research on profit and concentration has generally supported the Concentration-Collusion Doctrine. In our only textbook on industrial organization, Chris Green, who incidentally devotes the first four chapters to explaining how to apply the structure-conduct-performance paradigm, concludes that in considering Canadian and American work, "the empirical evidence supports the theoretical presumption that market power and profitability are directly related." [50] This conclusion is typical of most researchers in the field, although Professor Green's method of burying any conflicting evidence in the footnotes is unique.

Although there are many revisionist studies in the U.S., as discussed above, there is really only one revisionist researcher in Canada who is producing results that raise questions about the traditional view.

Two early studies looked at concentration in Canada, Gideon Rosenbluth being the first, in 1957 [51] and M. D. Stewart being the other, in 1970. [52] Each was restricted to an examination of structure *per se*, Rosenbluth using 1948 data and Stewart 1964, presumably because of the absence of adequate performance data.

In 1973, the recent release of concentration data for the manufacturing sector, combined with the incresing availability of performance data allowed the simultaneous publication of the first Canadian profit and concentration studies. Jones, Laudadio and Percy did a regression analysis of profitability for a sample of thirty consumer good industries in the year 1965. [53] Profitability was given by total return on assets and return on equity. The independant variables used were concentration, as measured by 4-firm concentration ratios and the Herfindahl index, product differentiation, growth of demand, scale economies, absolute

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[50]C. GREEN, CANADIAN INUSTRIAL ORGANIZATION AND POLICY (1980).
[51]G. ROSENBLUTH, CONCENTRATION IN CANADIAN MANUFACTURING INDUSTRIES (1957).
[52]M. STEWART, CONCENTRATION IN CANADIAN MANUFACTURING AND MINING INDUSTRIES (1970).
[53]Jones *et. al., Market Structure and Profitability in Canadian Manufacturing Industry: Some Cross-Sectional Results* , 6 THE CANADIAN JOURNAL OF ECONOMICS 356 (1973).

capital requirements, a regional variable and foreign competition. The study claimed that concentration, product differentiation, demand and foreign competition were the important determinants of inter-industry differences in profitability. However, foreign competition had an unexpectedly positive relationship to profitability, which the authors discounted as the result of the inadequate scope of a single cross-section analysis. They did seem satisfied with the positive relationship found for concentration.

Donald McFetridge did a similar regression analysis, this time using price-cost margins for a cross-section of 43 three digit *Standard Industrial Classification* (SIC) manufacturing industries during the period 1965 to 1969. [54] The same elements of industry structure used by Jones *et. al.* were used, though not identically modelled. The principal conclusion of the study was that, given the growth rate of demand and level of capital intensity, inter-industry differences in price-cost margins were significantly correlated with concentration. This correlation was more significant in the consumer goods sector than in the producer goods sector.

In 1977, Jones *et. al.* came out with a second study, this time using their regression model to compare the Canadian with the American manufacturing industry. [55] The purpose was to show the relevance of traditonal American studies of profit and concentration to Canadian policy. They found that, although some structural variables give rise to differences in performance beteen Canada and the U.S., there was significant compatibility when the same basic Concentration-Collusion Doctrine model of structure-performance was applied. However, they did qualify their conclusions by noting that multicolinearity had reduced the statistical and economic significance of their results.

A couple of years later, Jones published a study with A. E. Leeder which checked the continuity of their linear model of concentration and profits. [56] Profitabiltiy was measured as

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[54]McFetridge, *Market Structure and Cost-Price Margins: An Analysis of the Canadian Manufacturing Sector*, 6 THE CANADIAN JOURNAL OF ECONOMICS (1973).
[55]Jones *et. al., Profitability and Market Structure: A Cross-Section Comparison of Canadian and American Manufacturing Industry*, 25 JOURNAL OF INDUSTRIAL ECONOMICS 195 (1977).
[56]Leeder & Jones, *The Critical Concentration-Profitability Relationship and*

return on assets, with concentration measured by a 4-firm ratio. Their results suggested that there actually was a break point, in that return on assets only increased with the 4-firm concentration ratio after that ratio passed 33%. Below that value, there was either no relationship at all, or a *negative* one. Leeder and Jones argued that the discontinuous relationships they found were actually not clearly better on statistical grounds than the continuous one they prefered for good solid antitrust enforcement.

In 1982, Prescott and Tapon took the data used by Jones *et. al.* in their 1977 study and used ridge regression analysis. [57] This method is supposed to yield improved parameter estimates when the data are ill-conditioned, as Jones *et. al.*'s multicolinearity problem would indicate. Their conclusion was that "ridge regression is a potentially useful addition to the tool kit of economists working in the industrial organization field."[58]

In a recent working paper, Stanley Kardasz, using 4-firm concentration ratios and price-cost margins to measure "market power" carried on Leeder and Jones' search for a continuous relationship beween profits and concentration. Professor Kardasz, however, came up with a U-shaped function for margins and concentration. [59] According to Professor Kardasz, the only way to reconcile this result with a linearly increasing theoretical function is that there is systematic error in the published measures of concentration making empirical studies based on them unreliable. The possibility that profits and concentration do not have a linearly increasing relationship was not discussed.

In another study, done with Kenneth Stollery, [60] Professor Kardasz used simultaneous equations to seek support for the proposition of Professors Strickland and Weiss [61] that

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[56](cont'd) *Structure-Performance Model: Some Canadian Evidence*, 24 THE ANTITRUST BULLETIN 499 (1979).
[57]Prescott & Tapon, *Ridge Regression Estimates of the Profitability-Concentration Hypothesis: Some Canadian Evidence Revisited*, THE CANADIAN JOURNAL OF ECONOMICS (1982).
[58]*Ibid.*
[59]Kardasz, *Price-Cost Margins and Measured Concentration in Canadaian Manufacturing*, working paper, University of Waterloo.
[60]Kardasz & Stollery, *Simultaneous Equation Models of Profitability, Advertising and Concentration for Canadian Manufacturing Industries*, working paper, University of Waterloo.
[61]Strickland & Weiss, *Advertising, Concentration and Price-Cost Margins,* JOURNAL

advertising and concentration determine profits, profits and concentration determine advertising and advertising acts as a barrier to entry, determining concentration. Kardasz and Stollery explain their results as showing that advertsising is in fact a barrier to entry, but that it also enables smaller firms to operate! Again, they have a U-shaped function which they blame on Statistics Canada.

There currently are only two studies using Canadian data that are critical of the concentration-collusion doctrine. The first, by Joan Bodoff, is not really in the revisionist school either, as it is simply a replication of a previous study that supported the doctrine, this time using a widened data base. [62] David Schwartzman, using data from concentrated Canadian industries which were not concentrated in the United States, had concluded that concentrated industry prices were 8.3 percent higher than they would have been if those industries were not concentrated. [63] Professor Schwartzman's results might be explained by the differences in the scale of the two countries' industries. Insufficient scale to achieve economies and the smaller market could account both for the concentration occuring in the Candian industries while not in those in the United States, as well as for the higher Canadian prices. The issue, however, was more satisfactorily resolved by Professor Bodoff in a dissertation written under Professor Schwartzman's supervision. Professor Scwartzman's study had had to rely on the small sample of industries available from the 1954 census. Professor Bodoff took advantage of a larger body of data that became available from later censuses and found that there was no significant price difference.

The second study is by Roger Beck, and it is in fact the one genuinely revisionist study in Canada. [64] In this work, Professor Beck took the first step toward ending our complete dependence upon cross-section data by doing a time-series analysis of changes in profitability

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[61](cont'd) OF POLITICAL ECONOMY 1109 (1976).
[62]Bodoff, *Monopoly and Price Revisited*, in Y. BROZEN, ed. THE COMPETITIVE ECONOMY: SELECTED READINGS 175 (1975).
[63]Schwartzman, *The Effect of Monopoly on Price*, 67 JOURNAL OF POLITICAL ECONOMY 352 (1959).
[64]Beck, *Concentration and Performance: The New Thinking and Some Canadaian Evidence*, 2 MANAGERIAL & DECISION ECONOMICS 9 (1981).

and concentration in Canadian industry between 1948 and 1965. Industry profit rates were calculated for individual years, and then a 3-year average was calculated for two periods: 1948-50 and 1965-67. This data was coupled with the changes in the 4-firm concentration ratios of the industries studied. Professor Beck's findings were that changes in concentration between 1948 and 1965 did not bring the traditionally expected changes in profit rates. For one group of industries with declining concentration, no significant change occurred in the profit rate. Concentration increased for the other group of industries, but the profit rate actually fell. This is consistent with the new theory that an improvement in cost efficiency (not monopoly power) accompanies a rise in concentration; in such a case, the industry profit rate may well fall with the profits of firms that continue to rely on outdated methods.

Currently, Professor Beck is developing a study that is unique in Canada in that it continues and updates his time-series analysis *and adjusts profit by risk*. Furthermore, it uses market profitability, which has not been attempted before, either in Canada, or in the United States. The study looks for a significant and genuine relationship between concentration and profitability by discounting nominal market returns by the risk of the firm, based on Sharpe and Treynor measures. This takes care of the situation in which high concentration firms may earn higher profits because they take more risk, as their high concentration allows. Specifically, the study involves one-on-one comparisons of the discounted rates of return for firms in increasing concentration industries with those in decreasing concentration industries over the periods 1965-70, 1970-74 and 1965-74. As a result of the one-on-one comparisons, concentration was treated as a continuous variable. The study uses a z-statistic developed by Professors Jobson and Korkie specifically for the asymptotic distributions of the estimators of the Sharpe and Treynor measures used. [65] Professor Beck found that there was no significant domination by increasing concentration firms of decreasing concentration firms, whatever the period being studied and whatever the means of measuring risk.

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[65] Jobson & Korkie, *Performance Hypothesis Testing using Sharpe and Treynor Measures*, 36 THE JOURNAL OF FINANCE 889 (1981).

The study here is a continuation of Professor Beck's time-series, risk-adjusted profit approach, this time using the risk adjustment on accounting data and using aggregate comparisons so that the concentration variable is nominal.

4. Methodolgy

4.1 Performance Measurement

In this study, performance is measured as the change in three performance measures, using financial statement data over various time periods. The first is a quasi-Treynor measure, which, like the traditional Treynor measure, discounts nominal profitability by a measure of the *systematic* risk of the firm. [66] The second is a quasi-Sharpe measure, which, like the traditional Sharpe measure, discounts nominal profitability by the *general* risk of the firm. [67] The third is a non-risk-adjusted, or straight measure of nominal profitability. To determine nominal profitability, three accounting rates of return, r, are used:

$r_1 =$ *Net Income, Operations / Book Equity*

$r_2 =$ *(Net Income, Operations + Interest) / Book Assets*

$r_3 =$ *Net Income, Operations / Market Value of Equity*

r_1, the rate of profit on stockholders' equity, is the prefered measure of the traditional American studies, advocated by Bain,[68] Comanor and Wilson,[69] and Hall and Weiss.[70] r_2, total return on assets, has been advocated by the revisionist George Stigler as the best indication of a firm's behaviour. [71] r_3, return on the market value of common stock outstanding is a new measure not yet used in the literature. The change in the quasi-Treynor measure will be calculated, using r_1 and r_2, for 72 firms as:

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[66]For traditional Treynor measurement, *see* Treynor, *How to Rate Management of Investment Funds*, 43 HARVARD BUSINESS REVIEW 63 (1965).
[67]For tradtional Sharpe measurement, *see* W. SHARPE, PORTFOLIO THEORY & CAPITAL MARKETS ch. 8 (1970).
[68]Bain, *The Relation of Profit Rates to Industry Concentration in American Manufacturing, 1936-1940*, QUARTERLY JOURNAL OF ECONOMICS (Aug. 1951).
[69]Comanor & Wilson, *Advertising Market Structure and Performance*, 49 REVIEW OF ECONOMICS AND STATISTICS (Nov. 1967).
[70]Hall & Weiss, *Firm Size and Profitability*, 49 REVIEW OF ECONOMICS AND STATISTICS (Aug. 1967).
[71]G. STIGLER, CAPITAL AND RATES OF RETURN IN CANADIAN MANUFACTURING 123 (1963).

$$\Delta T = \bar{r}_{1973 - 1975} - \bar{r}_{1964 - 1966} / \beta_{1960 - 1978}$$

where

$\bar{r}$ = an arithmetic mean of an accounting rate of return over a three year period

β = an accounting beta based on a 19 year period and estimated by

$b = \Sigma(r - \bar{r})(r - \bar{r}) / \Sigma(r - \bar{r})^2$

with $r = 1/n \text{ w } \Sigma r$,*ie*. an average of all returns weighted according to total assets.

The accounting beta is modelled on Treynor's market beta, which is a measure of the responsiveness of a firm's earnings to the earnings of the market as whole. That covariability of the firm's earnings with aggregate earnings gives that responsiveness, or systematic risk of the firm. A beta for the whole period as opposed to a beta for each of the two endpoints of the period is used to maximize the number of observations, thereby minimzing the amount of measurement error, to which beta is highly suseptible. The use of one beta assumes that the riskiness of the firm does not change fundamentally over the course of the period.

The relationship between the accounting and market beta was first examined by Beaver, Kettler and Scholes who found a good correlation between the two. [72] That result was essentially confirmed by White [73] but challenged by Gonedes who was unable to detect a strong association. [74] He attributed the difference in findings to the use by Beaver *et. al.* of stock market prices to scale accounting numbers which may have introduced a spurious correlation.

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[72]Beaver *et. al., The Association Between Market and Accounting Determined Risk Measures*, 1970 THE ACCOUNTING REVIEW 654. The correlation at the individual security level was .44 for the period 1947-56, and .23 for the period 1957-65. The correlations at the portfolio level were almost identical. The authors conclusion was that "there is a high degree of contemporaneous association between the accounting and market risk measures. More precisely, a strategy of selecting and ranking portfolios according to accounting risk measures is essentially equivalent to a strategy of ranking these same portfolios according to the market determined risk measure." (p.679).

[73]White, *On the Measurement of Systematic Risk*, unpublished Ph.D. thesis, M.I.T., 1972.

[74]Gonedes, *Evidence on the Information Content of Acconting Messages: Accounting-Based and Market-Based Estimates of Systematic Risk*, JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS 407 (July, 1973).

Beaver and Manegold resolved the controversy by investigating a variety of specifications to test the association between accounting and market based beta's, and again reported a significant correlation, not due to scaling. [75] Similar corrleations were reported by Hill and Stone. [76] The estimation of the accounting beta, b, used in the Beaver and Manegold study was used in this study. The 19 observations used here is greater than that which is commonly accepted in the literature. [77]

The change in the quasi-Sharpe measure will be calculated, using r_1 and r_2, for 102 firms as:

$$\Delta S = \bar{r}_{1973-1975}/s_{1972-1976} - \bar{r}_{1964-1966}/s_{1963-1967}$$

where

s= sample standard deviation, based on a five-year period and calculated as:

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[75]Beaver & Manegold, *The Association Between Market-Determined Risk and Accounting Determined Risk Measures of Systematic Risk*, JOURNAL OF FINANCIAL & QUANTITATIVE ANALYSIS 231 (June 1975). In this study Beaver and Manegold explored the value of various methods of removing part of the measurement error in the accounting beta. This error is the result of the necessarily small samples in accounting data where observations are annual as opposed to monthly. They found that while transformations like the use of first differences and the Durbin technique were not effective in reducing error, a Bayesian adjustment was. The Bayesian adjustment uses the expected value of the prior distribution of all betas in the sample and their variance to "smooth" the individual beta towards the mean. As Bayesian statistics in general and this procedure in particular is not generally accepted, the technique was not used here.

[76]Hill & Stone, *Accounting Betas, Systematic Operating Risk, and Financial Leverage: A Risk-Composition Approach to the Determinants of Systematic Risk*, JOURNAL OF FINANCIAL & QUANTITATIVE ANALYSIS 595-637 (1980). Hill and Stone developed an accounting analogue to the Hamada-Rubinstein formaulas that resolve risk into two components - an intrinsic operating risk and financial risk. In their 1970 study, Beaver *et. al.* had found that financial structure, while it significantly corrletaed with the market beta had no significant explanatory value if added to a multivariate regression. Hill and Stone argue that it was misspecified as an additive, as opposed to mulitiplicative term, in that its effect is to magnify whatever the intrinsic operating risk of the firm is. This "Risk-Composed" accounting beta had very promising correlations in their study but the concept, by their own admission, is not yet fully developed. When it is, it may be a useful inclusion in studies such as this.

[77]In the first Beaver *et. al.* study, only 9 observations were used.

$$s = (\Sigma r^2 - (\Sigma r)^2/n)/n-1$$

Unlike the quasi-Treynor calculation, the quasi-Sharpe allows for changes in the risk of the firm over time as fewer observations are needed for reliable measures of general risk.

Two subperiods, A and B will also be calculated for the quasi-Sharpe measure.Subperiod A will be calculated with r_2 and r_3 on 139 firms as:

$$\Delta SA = \bar{r}_{1969-1971}/s_{1969-1972} - \bar{r}_{1964-1966}/s_{1962-1967}$$

Subperiod B will be calculated with r_1, r_2 and r_3 on 139 firms as:

$$\Delta SB = \bar{r}_{1973-1975}/s_{1971-1976} - \bar{r}_{1968-1971}/s_{1963-1972}$$

r_3 is restricted to subperiod B, and calculated on only 82 of the 139 firms in the sample because of data collection problems discussed below.

A change in straight profit (simply the change in the mean of the accounting rate of return) is calculated in order that the importance of risk adjustments can be discerned. This is done for the full period as well as subperiods A and B.

4.2 Performance Data Collection

Accounting data was collected on manufacturing firms over the period 1960 to 1978. The primary source used was the *Financial Post Survey of Industrials*, for the years 1961 through 1979. Although this entailed the manual collection of data, it was considered a preferable source to the alternative of *Compustat*, in that its Canadian Annual Data bank is

limited in coverage and thought by some to be unreliable in its reporting. Data files were constructed for various periods of interest by starting with a file on all firms reported by the *Financial Post Survey* that had four-digit SIC numbers. [78]From this, only firms with complete data for a period were retained. Where data was restated in a subsequent year, the restatement was taken rather than the original.

In the case of interest charge data, which was required for the calculation of r_2, a systematic gap in the *Financial Post* data for the years 1970-73, along with random gaps elsewhere, required the use of supplementary data sources. The two sources used were *Compustat* [79] and annual reports. Annual reports had to be used because *Compustat* covered only a fraction of the desired firms and, based on some random checks against annual reports, seemed chronically innacurate with regard to interest charge data. [80] In the event of discrepancies between the various sources, the order of priority was the annual report, the *Finacial Post Survey* and then *Compustat*. *Compustat* was used mainly as a last resort where there was no other data, or where other data was obviously inaccurate. The absence of data or inaccuracies stemmed from the fact that annual reports were rarely available for years prior to the 1970's, and while later reports often did include multi-year reviews, these generally used rounded figures. Even with the use of the various sources though, every firm in the sample had at least one year, and more usually several for which it did not report its interest expense. Where the gap was only one or two years, the average of the last and next available years was used as a proxy, or if the one or two year gap was at the beginning or end, the first or last available year was used. Where the gap was bigger, the proxy used was the average of the interest expense/(total assets - book equity) for the three next, or if unavailable, three last available years, giving a kind of interest rate, which was then multiplied by total assets - book equity for each year missing to give each an 'interest expense'. The three closest years, as

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[78]As opposed to the three-digit "class" of industry number.

[79]Canadian Annual Data, item 15

[80]The most serious problem was that the data was often out-of-sync with the year to which it was supposed to correspond. This could be the fault of the programming done in our own Faculty that allows simple interactive access to the data.

opposed to all available years were used to calculate an 'interest rate' because that rate changed systematically over time, which would have caused obvious distortions if an average for the whole period had been applied to gaps at the beginning or end of the period. The method was tested against a random sample of actual reported interest charges and found to be within 25% of the true figure, depending on the proximity of the years on which the proxy interest rate was calculated to the year in question. [81] Where three consecutive years of reported data were not available, proxies were based on an average of whatever three, or however many years were available, on an *ad hoc* basis.

In addition to this necessary data construction, there was a second problem of different firms having different definitions of "interest expense", treating it as long-term interest, net long-term and short-term interest, or a category generally termed "financial expense", which included all costs of debt without recognition of interest income. Moreover, in a number of cases, the same firm would change its definition. This seems to have gone unnoticed by *Compustat* which, while giving a very precise, uniform defintion actually generally reports whatever the firms report as "interest expense". In the sample under study, the majority, 44%, were net interest on long-term and short-term debt, 18% were long-term interest, 2% were financial expenses and 36% were unidentified. The best that can be done is to assume that the various definitions are distributed randomly among firms.

While interest charge was the only area in which substantial amounts of missing data had to be filled in, there were also the odd single cases of a missing figure. In such cases, where the figure could not be located through alternative sources, a simple average or nearest figure was used in its place.

The accounting rate of return r_3 required the market value of common stock outstanding as part of its calculation. *Compustat* would be one source of the data but its market value of common stock mismatches the number of common shares outstanding at the fiscal year end of the firm with their price at the calendar year end. Further, it covers only a fraction

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[81] Accuracy was calculated as 1-|actual-proxy/actual| on 15 firms, using a mix of near and distant years.

of the firms we are interested in, and when it does include them, sometimes only gives the figure for one of several classes of common stock. The best source is the *Toronto Stock Exchange Review*. Unfortunately, it only began in 1965. For this reason, r_3 was only calculated for subperiod B, which begins in 1968.

4.3 The Nature of Accounting Performance Data

Accounting data has one big advantage and that is that it is relatively easy to collect. Unfortunately, it has a fair number of disadvantages. In the context of this study, however, the effect of most of them is minimal, or can at least be minimzed.

First, it is questionable whether or not returns derived from accounting data are close to real economic returns. [82] Among others, there are the problems referred to earlier as critcisms of the traditional studies that relied on the data: it ignores intangible capital, inflation, the age of assets and writeoffs. This is one disadvantage that may be significant, but which we can't do much about, other than to acknowledge it.

A second disadvantage is the fact that, at least over the short run, accounting information can be manipulated. Professors Watson and Zimmerman have even suggested that the manipulation may be systematically tied to firm size. [83] Their finding was that small firms generally overstated earnings in order to attract investment attention whereas large firms tended to understate earnings in order *avoid* antitrust attention. While fear of combines prosecution is improbable in Canada, [84] political concerns may be genuine in the case of banks and the major oil companies. At the minimum though, as has been demonstrated in the "income smoothing" literature in accounting,[85] it is generally true that firms try to smooth out real fluctuations in order to give the appearance of stability. While this could be a significant distortion of a firm's performance in a single year, in a time-series study which tracks performance over several .

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[82]Fischer & McGowan, *On the Misuse of Accounting Rates of Return to Infer Monopoly Profits*, 73 AMERICAN ECONOMIC REVIEW 82 (1983).
[83]Watson & Zimmerman, ACCOUNTING REVIEW (Jan. 1978).
[84]Professor W. T. Stanbury is rumoured to have told a group of businessmen that they owed it to their shareholders to conspire.
[85]reference

years, the distortion should be eliminated. Moreover, to the extent that all firms follow this policy, it might not distort comparisons anyway.

Third is the problem of different accounting conventions across firms and, more importantly, across industries, and the fact that these conventions change. While this is a distortion, if it is assumed that industry conventions are not tied to concentration, it should not be a systematic distortion of a performance-concentration study and can be expected to average out over the whole sample. Again, over a long enough period of time, one would not expect different coventions to affect average reported performance. Fourth, there is the problem of different firms using different fiscal year ends for reporting purposes. Further, some firms change their fiscal year end regularly. Thus, whereas market studies can compare the performance of firms over the same calendar year, an accounting study may have up to an eleven month lag between two firms. For single firm comparisons this would be a distortion, but it is a distortion that will diminish with the number of years upon which performance is measured. For aggregate comparisons, one can expect the distortions to average out as the choice of fiscal years does not seem to be systematically determined. Also, at least in the sample used for this study, the vast majority of firms used December 31 as their fiscal year end. Finally, there could be the problem of certain firms reporting only in U.S. dollars, which would distort absolute comparisons between theses firms and others where there is a significant differential in the rate of exchange. However, it is a small minority of firms that do this, and , over time, neither currency has uniformly dominated the other. It is not a problem at all here, as it is *changes* in performance that are compared, so that absolute differences are rendered irrelevant.

4.4 Concentration Data and Measurement

Concentration data was collected for the years 1965, 1968, 1970, 1972 and 1974 from the biennial Statistics Canada publication *Industrial Organization and Concentration in*

Manufacturing and Logging Industries.[86] The concentration subperiod corresponding to performance subperiod A was 1965-1972, including reporting years 1965, 1968, 1970 and 1972. The concentration subperiod corresponding to performance subperiod B was 1968-1974, including reporting years 1968, 1970, 1972 and 1974.

Concentration was classified as *increasing* or *decreasing* depending on the change in the Herfindahl Index for the firm's industry during the period under study. The Herfindahl Index is calculated by summing the squares of the individual market shares of all the firms included in a market. Unlike the traditional 4-firm ratio, the Index reflects both the distribution of those firms and the composition of the market outside the top four firms. It also gives proportionately greater weight to the market shares of the larger firms, in accordance with their alleged importance in collusive activity.

Firms were also classified by low and high alleged break points in the profit-concentration relationship. This was done to test the belief of certain people that while the Concentration Collusion Doctrine does not hold true over all levels of concentration, it does beyond a certain point. The 1979 Jones and Leeder study found a break point at the 33% 4-firm ratio,[87] which is used here as the low break point. This figure translated into a .0453 on the Herfindahl Index, based on the average Herfindahl figure for all industries with 4-firms ratios of 33% plus or minus 1%. All firms above this .0453 figure were included in this group. As this seemed low, a high breakpoint of 55%, or .0874 on the Herfindahl Index was used as a high break point.

4.5 Hypothesis Testing

With the above data, we have the change in quasi-Treynor performance, ΔT, for 72 firms over the period 1960-1978, using two different accounting rates of return, the change in quasi-Sharpe performance, ΔS, for 102 firms over the period 1963-1976, with subperiod

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[86] *Supra* note 48.
[87] *Supra* note 56.

performance ΔSA on 139 firms over the period 1963-1972 and subperiod performance ΔSB on up to 139 firms over the period 1968-1976, using up to up to 3 different accounting rates of return, as well as straight profit changes on all firms over all quasi-Sharpe periods. In addition, we know how the concentration in each firm's industry changed over these various periods, as well as its absolute magnitude.

To test the hypothesis of the Concentration-Collusion Doctrine of high concentration firm dominance of low concentration firms, the sample of firms are grouped six different ways, according to how concentration in their industry changed over time:

1. *Industries which increased in concentration between the beginning and end of period vs. indusries which decreased*
2. *Industries which increased in concentration in every reporting year vs. industries which decreased in every reporting year*
3. *Industries above the low break point which increased in concentration between the beginning and end of period vs. indusries above the low break point which decreased*
4. *Industries above the low break point which increased in concentration in every reporting year vs. industries above the low break point which decreased in every reporting year*
5. *Industries above the high break point which increased in concentration between the beginning and end of period vs. indusries above the high break point which decreased*
6. *Industries above the high break point which increased in concentration in every reporting year vs. industries above the high break point which decreased in every reporting year*

Next, an inference framework for comparing two population means is developed, where

the population is the performance measures for all firms in Canada.[88] The sample random variables $\bar{X}_1$ (sample mean performance of increasing concentration firms), $\bar{X}_2$ (sample mean performance of decreasing concentration firms), S_1^2 (sample variance of increasing concentration firms), and S_2^2 (sample variance of decreasing concentration firms) are used to make inferences concerning the difference between the two population means, $D = \mu_1 - \mu_2$, where μ_1 is the mean performance of increasing concentration firms and μ_2 is the mean of the decreasing concentration firms. The best estimator of a population mean μ is the statistic $\bar{X}$ which, in our case, is the arithmetic mean of the performance figures of the increasing or decreasing concentration firms in the sample. As a result, the best point estimator of $D = \mu_1 - \mu_2$ is the difference between the statistics $\bar{X}_1 - \bar{X}_2$. In fact, the point estimator $d = \bar{X}_1 - \bar{X}_2$ is unbiased and minimum variance, *ie.* there is no "better" function of the two sets of sample values than $\bar{X}_1 - \bar{X}_2$ in estimating $\mu_1 - \mu_2$. To construct a confidence interval estimate for $D = \mu_1 - \mu_2$, because the values of $\bar{o}_1^2$ and $\bar{o}_2^2$, the population variance, are unknown, they must be estimated by the sample variance, s^2 and the confidence internal for μ is based on the t-distribution. Assuming that while $\bar{o}_1^2$ and $\bar{o}_2^2$ are unknown, they are equal, a $100(1-\alpha)$ perecent confidence interval estimate of the difference between the two population means, $\mu_1 - \mu_2$, is given by

$$(\bar{x}_1 - \bar{x}_2) \pm t \qquad s / 1/n_1 + 1/n_2$$

where x and n are the sample mean and sample size, respectively and s is the pooled standard deviation given by

$$s = / (n_1 - 1)s_1^2 + (n_2 - 1)s_2^2 / (n_1 - 1) + (n_2 - 1)$$

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[88]The statistical procedures used here are from R. PFAFFENBERGER & J. PATTERSON, STATISTICAL METHODS FOR BUSINESS AND ECONOMICS ch. 11 (1981).

and t is the point of the t-distribution with $n_1 + n_2 - 2$ degrees of freedom such that $P[t > t] = \alpha/2$. The confidence interval is exact if the population random variables $\bar{X}_1$ and $\bar{X}_2$ are normally distributed. While we could assume so, where n_1 and n_2 are each greater than 25, the resulting confidence interval is still acceptable as an approximation. For the hypothesis testing, we are statistically prevented from directly testing the concentration-collusion hypothesis that increasing concentration firms outperform decreasing concentration firms as H_0 must be an equality, *ie.* the only direct test would be that they do *at least as well as* decreasing concentration firms. Therefore we will state the null hypothesis as the difference in one of three forms:

$$H_0^1: \mu_1 - \mu_2 = D > D_0$$

$$H_0^2: \mu_1 - \mu_2 = D = D_0 \quad H_0^3: \mu_1 - \mu_2 = D < D_0$$

In these hypothesis statements, D_0 is the hypothesized difference, taken here to be zero. H_0^1 is the, weak, but only possible statement of the concentration-collusion hypothesis, which is that the mean performance of increasing concentration firms is as good or better than that of decreasing concentration firms. H_0^2 is a reasonable challenge to the concentration-collusion doctrine, stating that the means of the two groups are the same. H_0^3 is the strongest possible contradiction of the Concentration-Collusion hypothesis, stating that it is the mean of the decreasing concentration firms that is as good as or better than that of the increasing concentration firms. In order to reject this hypothesis, one would have to find a positive correlation between performance and concentration. The alternative hypothesis, which we would have to accept if we rejected this, is exactly the concentration-collusion hypothesis, *ie.* $D > D_0$. The test statastic value is:

$$t = (\bar{x}_1 - \bar{x}_2) - D_0 / s \cdot / 1/n_1 + 1/n_2$$

The rejection region is as follows:

Reject H_0^1 if $t < -t$

Reject H_0^2 if $t < -t$ or $t > t$

Reject H_0^3 if $t > t_2$

For H_0^1, p-value = $P(t < t)$. For H_0^2, p-value = $2P(t > |t|)$. For H_0^3, p-value = $P(t > t)$.

5. Results

Definition of Symbols

X1 = mean performance of increasing concentration firms

X2 = mean performance of decreasing concentration firms

N1 = number of increasing concentration firms

N2 = number of decreasing concentration firms

V1 = variance of increasing concentration firms

V2 = variance of decreasing concentration firms

ΔTr_1 = change in quasi-Treynor performance using Net Income, Operations/Book Equity

ΔTr_2 = change in quasi-Treynor performance using (Net Income, Operations + Interest)/ Book Equity

ΔSr_1 = change in quasi-Sharpe performance using Net Income, Operations/Book Equity

ΔSr_2 = change in quasi-Sharpe performance using (Net Income, Operations + Interest)/ Book Equity

ΔSAr_1 = change in quasi-Sharpe performance in subperiod A using Net Income, Operations/Book Equity ΔSAr_2 = change in quasi-Sharpe performance in subperiod A using (Net Income, Operations + Interest)/ Book Equity

ΔSBr_1 = change in quasi-Sharpe performance in subperiod B using Net Income, Operations/Book Equity ΔSBr_2 = change in quasi-Sharpe performance in subperiod B using (Net Income, Operations + Interest)/ Book Equity

ΔSBr_3 = change in quasi-Sharpe performance in subperiod B using Net Income, Operations/ Market Value of Equity

Table I: Comparisons of Risk-Adjusted Performance of Firms that Increased in Concentration Between the Beginning and End of Period v. Firms that Decreased (Group 1)

Measure	X1	N1	V1	X2	N2	V2	t-value
ΔTr_1	-0.0280	32.	0.4060	0.0910	40.	0.2200	-0.9125
ΔTr_2	-0.0030	32.	0.1490	-0.0470	40.	0.0510	0.6038
ΔSr_1	-13.4890	43.	622.9800	-8.0470	59.	152.3440	-1.4507
ΔSr_2	-6.5700	43.	182.3400	-7.8250	59.	179.4450	0.4657
ΔSAr_1	-4.0590	61.	123.0150	-5.2580	78.	149.7470	0.5971
ΔSAr_2	-9.5340	61.	323.7891	-6.1560	78.	257.6479	-1.1674
ΔSBr_1	-8.5770	49.	311.6841	-2.6040	90.	180.2580	-2.2364
ΔSBr_2	-3.0960	49.	164.8440	-0.9560	90.	69.9650	-1.1865
ΔSBr_3	-4.2180	25.	69.7821	-1.0100	57.	21.0490	-2.6491

Table II: Comparisons of Unadjusted Performance of Firms that Increased in Concentration Between the Beginning and End of Period v. Firms that Decreased (Group 1)

Measure	X1	N1	V1	X2	N2	V2	t-value
Δr_1	0.0110	43.	0.0060	0.0620	59.	0.0120	-2.6123
Δr_2	0.0140	43.	0.0010	0.0240	59.	0.0010	-1.5771
ΔAr_1	-0.4460	61.	1.1570	-0.2280	78.	0.1950	-1.6247
ΔAr_2	-0.0290	61.	0.0080	-0.0380	78.	0.0110	0.5350
ΔBr_1	0.0480	49.	0.0140	0.1080	90.	0.0610	-1.6015
ΔBr_2	0.0300	49.	0.0030	0.0030	90.	0.0010	3.6877
ΔBr_3	0.0140	25.	0.0026	0.2100	57.	0.1120	-3.0887

Table III: Comparisons of Risk-Adjusted Performance of Firms that Increased in Concentration in Every Reporting Year v. Firms that Decreased (Group 2)

Measure	X1	N1	V1	X2	N2	V2	t-value
ΔTr_1	-0.2630	13.	0.9210	-0.0660	11.	0.2320	-0.6168
ΔTr_2	0.1040	13.	0.1050	0.0130	11.	0.0020	0.9209
ΔSr_1	-18.8480	17.	772.5029	-1.1570	14.	17.5160	-2.3528
ΔSr_2	-7.9110	17.	249.5120	-0.0450	14.	10.4830	-1.8267
ΔSAr_1	-3.0190	41.	74.2450	-5.2020	41.	100.4240	1.0576
ΔSAr_2	-4.4640	41.	117.8480	-3.7470	41.	83.3010	-0.3237
ΔSBr_1	-7.0200	31.	290.8391	0.4430	44.	9.6370	-2.8444
ΔSBr_2	-3.3790	31.	165.0160	0.7180	44.	21.7710	-1.9457
ΔSBr_3	-4.0210	12.	59.4715	-0.0890	31.	0.0880	-2.8895

Table IV: Comparisons of Unadjusted Performance of Firms that Increased in Concentration in Every Reporting Year v. Firms that Decreased (Group 2)

Measure	X1	N1	V1	X2	N2	V2	t-value
Δr_1	0.0250	17.	0.0020	0.0940	14.	0.0360	-1.4560
Δr_2	0.0190	17.	0.0010	0.0350	14.	0.0010	-1.4019
ΔAr_1	-0.3000	41.	0.9800	-0.2310	41.	0.2050	-0.4059
ΔAr_2	-0.0110	41.	0.0070	-0.0080	41.	0.0040	-0.1832
ΔBr_1	0.0250	31.	0.0280	0.1370	44.	0.1100	-1.7291
ΔBr_2	0.0250	31.	0.0050	0.0440	44.	0.0008	-1.7875
ΔBr_3	0.0100	12.	0.0020	0.2430	31.	0.1090	-2.5124

Table V: Comparisons of Risk-Adjusted Performance of Firms Above the Low Break Point that Increased in Concentration Between the Beginning and End of Period v. Firms Above the Low Break Point that Decreased (Group 3)

Measure	X1	N1	V1	X2	N2	V2	t-value
ΔTr_1	0.0770	16.	0.0396	0.0536	30.	0.2708	0.1725
ΔTr_2	-0.0057	16.	0.3159	-0.0185	30.	0.0252	0.1173
ΔSr_1	-2.8521	20.	27.7210	-2.5424	46.	21.5201	-0.2392
ΔSr_2	-4.1022	20.	64.6533	-2.4633	46.	34.9225	-0.9251
ΔSAr_1	-0.4076	32.	79.7236	-1.6933	52.	22.4624	0.8616
ΔSAr_2	-2.0509	32.	4.2062	-1.6356	52.	33.9318	-0.3880
ΔSBr_1	-2.6146	22.	26.8754	-0.8818	62.	54.5100	-1.0139
ΔSBr_2	-2.1169	22.	23.1388	0.2562	62.	23.1119	-1.9888
ΔSBr_3	-3.1380	8.	12.4621	-0.0092	26.	0.0221	-4.6723

Table VI: Comparisons of Unadjusted Performance of Firms Above the Low Break Point that Increased in Concentration Between the Beginning and End of Period v. Firms Above the Low Break Point that Decreased (Group 3)

Measure	X1	N1	V1	X2	N2	V2	t-value
Δr_1	0.0035	20.	0.0061	0.0380	46.	0.0049	-1.7767
Δr_2	0.0068	20.	0.0021	0.0165	46.	0.0015	-0.8841
ΔAr_1	-0.1637	32.	0.6226	-0.0329	52.	0.0058	-1.1909
ΔAr_2	-0.0010	32.	0.0063	-0.0071	52.	0.0008	0.5060
ΔBr_1	0.0113	22.	0.0117	0.0748	62.	0.0095	-2.5508
ΔBr_2	0.0103	22.	0.0032	0.0316	62.	0.0013	-2.0307
ΔBr_3	0.0110	8.	0.0029	0.0699	26.	0.2913	-0.3049

Table VII: Comparisons of Risk-Adjusted Performance of Firms Above the Low Break Point that Increased in Concentration in Every Reporting Year v. Firms Above the Low Break Point that Decreased (Group 4)

Measure	X1	N1	V1	X2	N2	V2	t-value
ΔTr_1	-0.1340	2.	0.2230	-0.1680	7.	0.4030	0.0690
ΔTr_2	0.6030	2.	0.6600	0.0080	7.	0.0	2.4168
ΔSr_1	-5.6060	3.	0.9730	-1.0080	9.	14.5120	-2.0074
ΔSr_2	-4.7000	3.	1.1330	-0.4490	9.	12.9610	-1.9590
ΔSAr_1	-1.3430	19.	4.0800	-2.3630	28.	30.1930	0.7722
ΔSAr_2	-1.0190	19.	10.2820	-1.6020	28.	32.1650	0.4054
ΔSBr_1	-1.3000	10.	15.6690	0.1010	30.	7.3850	-1.2550
ΔSBr_2	-1.2690	10.	26.7540	0.4430	30.	23.9250	-0.9454
ΔSBr_3		0.					

Table VIII: Comparisons of Unadjusted Performance of Firms Above the Low Break Point that Increased in Concentration in Every Reporting Year v. Firms Above the Low Break Point that Decreased (Group 3)

Measure	X1	N1	V1	X2	N2	V2	t-value
Δr_1	-0.0650	3.	0.0060	0.0550	9.	0.0070	-2.1828
Δr_2	-0.0290	3.	0.0040	0.0360	9.	0.0020	-1.9902
ΔAr_1	-0.2550	19.	1.0430	-0.0360	28.	0.0110	-1.1318
ΔAr_2	0.0070	19.	0.0090	-0.0650	28.	0.0010	3.7378
ΔBr_1	-0.0380	10.	0.0160	0.0940	30.	0.0100	-3.3826
ΔBr_2	-0.0120	10.	0.0040	0.0390	30.	0.0010	-3.3770
ΔBr_3		0.					

Table IX: Comparisons of Risk-Adjusted Performance of Firms Above the High Break Point that Increased in Concentration Between the Beginning and End of Period v. Firms Above the High Break Point that Decreased (Group 5)

Measure	X1	N1	V1	X2	N2	V2	t-value
ΔTr_1	0.0535	11.	0.0556	0.0385	24.	0.3388	0.0819
ΔTr_2	-0.0466	11.	0.4643	-0.0261	24.	0.0314	-0.1396
ΔSr_1	-2.6548	15.	34.4160	-2.1945	40.	23.5034	-0.2960
ΔSr_2	-4.2099	15.	81.1973	-2.4776	40.	39.9699	-0.8023
ΔSAr_1	0.3054	24.	95.6366	-1.5063	44.	24.2697	1.0185
ΔSAr_2	-2.3226	24.	23.8243	-1.7325	44.	54.1673	-0.3522
ΔSBr_1	-1.7834	13.	23.6465	-0.9172	54.	61.4344	-0.3799
ΔSBr_2	-1.8920	13.	17.9122	0.0184	54.	18.8914	-1.4296
ΔSBr_3		0.					

Table X: Comparisons of Unadjusted Performance of Firms Above the High Break Point that Increased in Concentration Between the Beginning and End of Period v. Firms Above the High Break Point that Decreased (Group 5)

Measure	X1	N1	V1	X2	N2	V2	t-value
Δr_1	-0.0141	15.	0.0064	0.0367	40.	0.0055	-2.2151
Δr_2	0.0043	15.	0.0021	0.0159	40.	0.0016	-0.9206
ΔAr_1	-0.0440	24.	0.0082	-0.0307	44.	0.0076	-0.5931
ΔAr_2	-0.0266	24.	0.0031	-0.0036	44.	0.0011	-2.1381
ΔBr_1	0.0092	13.	0.0100	0.0827	54.	0.0145	-2.0349
ΔBr_2	0.0035	13.	0.0030	0.0328	54.	0.0015	-2.2499
ΔBr_3		0.					

Table XI: Comparisons of Risk-Adjusted Performance of Firms Above the High Break Point that Increased in Concentration in Every Reporting Year v. Firms Above the High Break Point that Decreased (Group 6)

Measure	X1	N1	V1	X2	N2	V2	t-value
ΔTr_1	-0.4680	1.	0.0000	-0.2696	5.	0.5573	-0.2426
ΔTr_2	1.1775	1.	0.0000	-0.0073	5.	0.0009	36.0523
ΔSr_1	-5.0370	2.	0.0048	0.4889	7.	7.0986	-2.7939
ΔSr_2	-5.2920	2.	0.0116	-0.2691	7.	14.4420	-1.9712
ΔSAr_1	-1.7262	13.	7.0880	-1.9318	23.	34.3933	0.1191
ΔSAr_2	-1.8309	13.	11.6442	-1.4812	23.	67.9496	-0.1453
ΔSBr_1	-1.2007	6.	10.1078	0.1809	24.	12.1507	-0.1722
ΔSBr_2	-0.8245	6.	23.8120	-0.5280	24.	12.1507	-0.1722
ΔSBr_3		0.					

Table XII: Comparisons of Unadjusted Performance of Firms Above the High Break Point that Increased in Concentration in Every Reporting Year v. Firms Above the High Break Point that Decreased (Group 6)

Measure	X1	N1	V1	X2	N2	V2	t-value
Δr_1	-0.1091	2.	0.0010	0.0644	7.	0.0092	-2.4150
Δr_2	-0.0606	2.	0.0033	0.0453	7.	0.0023	-2.6723
ΔAr_1	-0.0506	13.	0.0058	-0.0364	23.	0.0153	-0.3744
ΔAr_2	-0.0032	13.	0.0037	-0.0222	23.	0.0020	1.0739
ΔBr_1	-0.0385	6.	0.0120	0.0956	24.	0.0102	-2.8643
ΔBr_2	-0.0200	6.	0.0038	0.0390	24.	0.0007	-3.6509
ΔBr_3		0.					

6. Analysis

H_0^1, which hypothesizes a significant positive relationship between performance and concentration can be rejected with a high degree of confidence over a wide variety of performance measures, both risk-adjusted and unadjusted, without regard to any so-called break points in concentration. H_0^2, which hypothesizes no significant relationship between performance and concentration can also be generally rejected though in fewer instances and with less confidence. H_0^3, which hypothesizes a significant negative relationship between performance and concentration - the exact opposite of the Concentration-Collusion Doctrine - can only be rejected in a handful of generally questionable instances. The consistency of the risk and unadjusted performance measures suggests that risk, as defined here, is evenly distributed amongst firms.

In Group 1 (Tables I & II), which compares firms in industries which increased in concentration between the beginning and end of the period with those that decreased, H_0^1 can be rejected in 8 cases: ΔSr_1 with 90% confidence and $p = .075$; ΔSBr_1 with 97.5% confidence and $p = .015$; ΔSBr_3 with 99% confidence and $p = .005$; Δr_1 with 99% confidence and $p = .005$; Δr_2 with 90% confidence and $p = .075$; ΔAr_1 with 90% confidence and $p = .05$; ΔBr_1 with 90% confidence and $p = .05$; ΔBr_3 with 99% confidence and $p = .000$. H_0^2 can be rejected in 5 cases: ΔSBr_1 with 95% confidence and $p = .04$; ΔSBr_3 with 97.5% confidence and $p = .01$; Δr_1 with 97.5% confidence and $p = .02$; ΔBr_2 with 99.5% confidence and $p = .005$. H_0^3 only can be rejected in 2 instances: ΔBr_2 with 99.5% confidence and $p = .005$; ΔBr_3 with 99.5% confidence and $p = .000$; ΔBr_2 is an unadjusted performance measure, comprising only a subperiod and relies on the less than reliable interest charge data for its profit calculation.

In Group 2 (Tables III & IV), which compares firms in industries which increased in concentration in every reporting year with those that decreased, H_0^1 can be rejected in 10 cases: ΔSr_1 with 97.5% confidence and $p = .015$, assuming normality as the number of observations of increasing and decreasing firms (the "N's") are less than 25; ΔSr_2 with 95% confidence and $p = .035$, assuming normality; ΔSBr_1 with 99% confidence and $p = .000$; ΔSBr_2 with 95%

confidence and p = .025; ΔSBr_3 with 99.5% confidence and p = .000, assuming normality; Δr_1 with 90% confidence and p = .075, assuming normality; Δr_2 with 90% confidence and p = .08, assuming normality; ΔBr_1 with 95% confidence and p = .035; ΔBr_2 with 95% confidence and p = .03; ΔBr_3 with 99% confidence and p = .007, assuming normality; H_0^2 can be rejected in 8 cases: ΔSr_1 with 95% confidence and p = .06, assuming normality; ΔSr_2 with 90% confidence and p = .14, assuming normality; ΔSBr_1 with 99.5% confidence and p = .01; ΔSBr_2 with 90% confidence and p = .10; ΔSBr_3 with 99.5% confidence and p = .01, assuming normality; ΔBr_1 with 90% confidence and p = .14; ΔBr_2 with 90% confidence and p = .14; ΔBr_3 with 97.5% confidence and p = .018, assuming normality; H_0^3 cannot be rejected.

In Group 3 (Tables V & VI), which compares firms in industries above the low break point which increased in concentration between the beginning and end of the period with those that decreased, H_0^1 can be rejected in 5 cases: ΔSBr_2 with 95% confidence and p = .03; ΔSBr_3 with 99.5% confidence and p = .000, assuming normality; Δr_1 with 95% confidence and p = .035; ΔBr_1 with 99% confidence and p = .008; ΔBr_2 with 97.5% confidence and p = .023. H_0^2 can be rejected in 5 cases: ΔSBr_2 with 90% confidence and p = .16; ΔSBr_3 with 99.5% confidence and p = .000, assuming normality; Δr_1 with 90% confidence and p = .14; ΔBr_1 with 97.5% confidence and p = .06; ΔBr_2 with 95% confidence and p = .08. H_0^3 cannot be rejected.

In Group 4 (Tables VII & VIII), which compares firms in industries above the low break point which increased in concentration in every reporting year with those that decreased, H_0^1 can be rejected in 6 cases: ΔSr_1 with 95% confidence and p = .035, assuming normality; ΔSr_2 with 95% confidence and p = .037, assuming normality; Δr_1 with 95% confidence and p = .03, assuming normality; Δr_2 with 95% confidence and p = .036, assuming normality; ΔBr_1 with 99.5% confidence and p = .000, assuming normality; ΔBr_2 with 99.5% confidence and p = .000, assuming normality. H_0^2 can be rejected in 8 cases: ΔTr_2 with 95% confidence and p = .08, assuming normality; ΔSr_1 with 90% confidence and p = .14, assuming normality; ΔSr_2 with 90% confidence and p = .16, assuming normality; Δr_1 with 90% confidence and p = .12, assuming normality; Δr_2 with 90% confidence and p = .14; ΔAr_2 with 99.5% confidence and p = .005,

assuming normality; ΔBr_1 with 99.5% confidence and p=.006, assuming normality; ΔBr_2 with 99.5% confidence and p=.006, assuming normality; H_0^3 can be rejected in 2 cases: ΔTr_2 with 97.5% confidence and p=.021, assuming normality; ΔAr_2 with 99.5% confidence and p=.000, assuming normality.

In Group 5 (Tables IX & X), which compares firms in industries above the high break point which increased in concentration between the beginning and end of the period with those that decreased, H_0^1 can be rejected in 5 cases: ΔSBr_2 with 90% confidence and p=.075, assuming normality; Δr_1 with 97.5% confidence and p=.015, assuming normality; ΔAr_2 with 97.5% confidence and p=.02; ΔBr_1 with 97.5% confidence and p=.023, assuming normality; ΔBr_2 with 97.5% confidence and p=.015, assuming normality. H_0^2 can be rejected in 4 cases: Δr_1 with 95% confidence and p=.04, assuming normality; ΔAr_2 with 95% confidence and p=.07; ΔBr_1 with 95% confidence and p=.09, assuming normality; ΔBr_2 with 95% confidence and p=.04, assuming normality; H_0^3 cannot be rejected. ΔTr_2 with 97.5% confidence and p=.021, assuming normality; ΔAr_2 with 99.5% confidence and p=.000, assuming normality.

In Group 5 (Tables IX & X), which compares firms in industries above the high break point which increased in concentration between the beginning and end of the period with those that decreased, H_0^1 can be rejected in 5 cases: ΔSBr_2 with 90% confidence and p=.075, assuming normality; Δr_1 with 97.5% confidence and p=.015, assuming normality; ΔAr_2 with 97.5% confidence and p=.02; ΔBr_1 with 97.5% confidence and p=.023, assuming normality; ΔBr_2 with 97.5% confidence and p=.015, assuming normality. H_0^2 can be rejected in 4 cases: Δr_1 with 95% confidence and p=.04, assuming normality; ΔAr_2 with 95% confidence and p=.07; ΔBr_1 with 95% confidence and p=.09, assuming normality; ΔBr_2 with 95% confidence and p=.04, assuming normality; H_0^3 cannot be rejected. ΔTr_2 with 97.5% confidence and p=.021, assuming normality; ΔAr_2 with 99.5% confidence and p=.000, assuming normality.

In Group 6 (Tables XI & XII), which compares firms in industries above the high break point which increased in concentration in every reporting year with those that decreased, H_0^1 can be rejected in 3 cases: ΔSr_1 with 97.5% confidence and p=.015, assuming normality;

ΔBr_1 with 99.5% confidence and p=.003, assuming normality; ΔBr_2 with 99.5% confidence and p=.000, assuming normality. H_0^2 can be rejected in 4 cases: ΔTr_2 with 99.5% confidence and p=.000, assuming normality; ΔSr_1 with 95% confidence and p=.06, assuming normality; ΔBr_1 with 99% confidence and p=.016, assuming normality; ΔBr_2 with 99.5% confidence and p=.001, assuming normality; H_0^3 can only be be rejected in 1 instance: ΔTr_2 with 99.5% confidence and p=.000, assuming normality. In that case the assumption of normality is of little help as N1=1.

The relative perfomances of the competing hypotheses is summarized in Table XIII below:

Table XIII: Rejection Count of H_0^1,H_0^2 and H_0^3

Group	H_0^1	H_0^1	H_0^1
1 (Tables I & II	8	5	1
2 (Tables III & IV	10	8	0
3 (Tables V & VI	5	5	0
4 (Tables VII & VIII	6	8	2
5 (Tables IX & X	5	4	0
6 (Tables XI & XII	3	4	1

In reading this Table with regard to the break points in concentration, it should be noted that after Table VI, ΔSBr_3 is unavailable as there were no increasing concentration firm observations. As ΔSBr_3 consistently rejected H_0^1 and H_0^2, their slight decline in rejection count in the break point analysis is likely explained by this lost measure. Furthermore, even if there was some decrease in the rejection count of H_0^1 and H_0^2, there is no apparent increase in the rejection

count on H_0^3.

7. Conclusions

This study suggests that the Concentration-Collusion Doctrine is questionable. Unlike previous Canadian studies using cross-sectional analysis which have found the consistently positive relationship between profit and concentration that supports it, the evidence here, which is based on data taken over a number of years, is that there has been in fact a negative relationship between profit and concentration. Moreover, this negative relationship extends over the whole range of concentration. This cannot be explained by the Concentration-Collusion Doctrine.

Further work is clearly needed to further test the Concentration-Collusion Doctrine. In this regard, Professor Beck's work using market data will be compelling for its sophistication and comprehensiveness. As for the accounting-based research done here, a next imporatant step would be the addition of more variables. Unfortunately this is a task that will require a very large data collection commitment. However, such work is critical because the Concentration-Collusion Doctrine, if only because of its longevity, will take unexceptionable proof to dislodge. In the United States, they had good arguments for dislodging the Concentration Collusion Doctrine long before it was effectively dislodged — what did it was overwhelming evidence. This is the challenge that faces the enlightened researcher of industrial organization in Canada today.

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